tridactylus, and in some measure also the didactylus, has a similar distribution of these arteries.

This peculiar disposition of the arteries in the limbs of these slow-moving quadrupeds, it is thought cannot but retard the velocity of the blood passing into the muscles of the limbs. Whence the well known sluggishness of the animals, to whom this configuration seems as yet peculiar, will perhaps be ultimately accounted for. Something similar has been observed in the carotid artery of the lion, which it is thought may be subservient to the long continued exertion of the muscles of his jaws, in holding a powerful animal for a length of time; and lastly, it is conjectured that the ruminating animals have a somewhat similar aplexus of arteries in the neck, which operates in retarding the velocity of the fluids in those parts.

*Outlines of Experiments and Inquiries respecting Sound and Light. By* Thomas Young, *M.D. F.R.S. In a Letter to* Edward Whitaker Gray, *M.D. Sec.R.S.* Read Jan. 16, 1800. [*Phil. Trans.* 1800, *p.* 106.]

We are here presented with a numerous set of experiments and observations, which the author does not deliver as a series calculated to elucidate any particular object, but rather as the results of the first steps of an investigation; which being of considerable magnitude, and not to be accomplished in a short period of time, are here brought forward in a detached form, in order to preserve them from oblivion, should any unforeseen circumstances prevent his continuing the pursuit. They are classed under sixteen different heads, of which the following are the titles, and some of the principal inductions.

1. *Of the Quantity of Air discharged through an Aperture.*—This was deduced from the quantity of pressure of water, on a body of air rushing through a small aperture at the end of a tube. The result was, that the quantity of air discharged by a given aperture is nearly in the subduplicate ratio of the pressure; and that the ratio of the expenditures by different apertures, with the same pressure, lies between the ratio of their diameters, and that of their areas.

2. *Of the Direction and Velocity of a Stream of Air.*—These were determined by the stream, produced by a known pressure, being made to impinge, in a perpendicular direction, against a white plate, on which a scale of equal parts was delineated, and which was thinly covered with a coloured liquid. The results were here inferred from the breadth of the surface of the plate laid bare by the stream.—The experiments being repeated at different distances between the orifice and the plate, the longitudinal form of the stream could be hence deduced, their sections being bounded by curves, the nature of which could be determined by their ordinates and abscissæ. The numerous results obtained in this manner are entered in various tables, and likewise illustrated by figures, in which the longitudinal and not the transverse sections are exhibited to the eye.

3. *Ocular Evidence of the Nature of Sound.*—This is produced by

a stream of air driven through a pipe with a lateral aperture, like a French flute, where at the part where the stream issues out of the orifice, vibrations are manifestly perceived, which are rendered still more evident if the current be impregnated with smoke.

4. *Of the Velocity of Sound.*—The velocity of any impression transmitted by the common air, being corrected by the experiments of various observers, is at an average here estimated at 1130 feet in a second of time.

5. *Of Sonorous Cavities.*—What is here said relates chiefly to the reflection of sounds in rooms or galleries. This we find takes place as often in a second as double the breadth of the room or passage is contained in 1130 feet, that breadth determining the pitch of the musical note thereby produced.

6 *Of the Divergence of Sound.*—Various observations are here related which militate against the received opinion that sound diverges equally in all directions, and that there is no substance impervious to sound. On this head, however, the author admits that a more ample investigation will be required than has hitherto been instituted; and he intimates that he shall engage in it as soon as his leisure will permit.

7. *Of the Decay of Sound.*—The two hypotheses, 1st, that sound decays nearly in the simple ratio of the distances, and 2nd, that this diminution is in the subduplicate ratio, are here stated, and some fallacies are mentioned, which will likewise render a further inquiry necessary.

8. *Of the Harmonic Sounds of Pipes.*—The object of this section appears from a table exhibiting the results of a set of experiments, made with a view to ascertain the velocity with which organ-pipes of different lengths require to be supplied with air, according to the various appropriate sounds which they produce.

These were made on pipes of the same bore, and of different lengths, both stopped and open. The general result was, that a similar blast produced as nearly the same sound as the length of the pipe would permit, or at least that the exceptions, though very numerous, lie equally on each side of this conclusion.

9. *Of the Vibrations of different Elastic Fluids.*—The difference of these vibrations has been received as being reciprocally in the subduplicate ratio of the density of the fluid. Hence in pure hydrogen gas they must be 3·6 times greater than in common air. And this will explain why an instrument will often appear out of tune, when, in fact, the fault lies in the change of temperature of the atmosphere; and why the pitch of an organ will be found to differ materially in summer and winter.

10. *Of the Analogy between Light and Sound.*—While the author vindicates the Newtonian theory of light against the criticisms of Euler, he freely admits that it is liable to some objections, among which he chiefly insists upon the uniformity of the motion of light in the same medium, and the partial reflection from every refracting surface. Having reasoned largely upon this subject, he admits the

probability of an analogy between the colours of a thin plate and the sounds of a series of organ-pipes; and observes that the same colour recurs whenever the thickness of the plate answers to the terms of an arithmetical progression, in the same manner as the same sound is produced by means of an uniform blast from organ-pipes which are different multiples of the same length.

11. *Of the Coalescence of Musical Sounds.*—In this section Dr. Smith's assertion that the vibrations constituting different sounds are able to cross each other in all directions, without affecting the same individual particles of air by their joint forces, is minutely investigated and controverted.

12. *Of the Frequency of Vibrations constituting a given Note.*

13. *Of the Vibrations of Chords.*

14. *Of the Vibrations of Rods and Plates.*

Of the contents of these three sections no account will be here attempted, as they consist chiefly of experiments and demonstrations illustrated by diagrams.

15. *Of the Human Voice.*—A technical description is here given of the formation of sounds by the configuration and inflexions of the different parts of the vocal organ. And it is intimated that by a close attention to the harmonics entering into the constitution of various sounds, much more may be done in their analysis than could otherwise be expected.

16. *Of the Temperament of Musical Intervals.*—After pointing out some imperfections in most of those who have treated this subject before him, the author suggests his own method of distributing the imperfection of the scale, so as to produce a modulation that shall be found the least defective. And here he observes, as upon an average of all music ever composed some particular keys occur at least twice as often as others, there seems to be a very strong reason for making the harmony the most perfect in those keys which are the most frequently used; since the aggregate sum of all the imperfections which occur in playing, must by this means be diminished the most possible, and the diversity of the character at the same time accurately preserved.

*Observations on the Effects which take place from the Destruction of the Membrana Tympani of the Ear. By Mr.* Astley Cooper. *In a Letter to* Everard Home, *Esq. F.R.S., by whom some Remarks are added.* Read Feb. 6, 1800. [*Phil. Trans.* 1800, *p.* 151.]

The case to which we owe the observations contained in this paper, is that of a youth, who at the age of ten was attacked with an inflammation and suppuration in the left ear, which continued discharging matter for several weeks; and who after the space of about a twelvemonth had the same symptoms in his right ear, the discharge in both cases being thin and fetid, and conveying many small bones and particles of bones. On probing the ears when the youth was about twenty years of age, it was found that the membrana tympani